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ABSTRACT

A semistructured research interview was used to study current task analysis procedures used by Air Force technical training personnel, and to develop and field test an improved task analysis procedure for designing and conducting technical training courses. It was found that current task analysis procedures varied widely, and that no individual or group was responsible for task analysis procedures. A simplified task analysis procedure was recommended, including development of improved methods for in-process reviews. It was also recommended that the feasibility of providing an automated information storage and retrieval system for task analysis data be studied. A handbook was developed which explains task analysis as a three-stage process: (1) converting training standards to preliminary criterion objectives; (2) subdividing the criterion objectives into component subtasks; and (3) determining the skills and knowledge underlying each subtask. (Plans are described for field testing the task analysis procedures described in the handbook). (MH)

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Methods for Collecting and Analyzing Task Analysis Data

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Since the U.S. Air Force (AF) developed its first major instructional system in 1965, the systems approach to training has received considerable emphasis within the Department of Defense and in the civilian sector. The issuance of AF Manual (AFM) 50-2, Instructional System Design, and AF Pamphlet (AFP) 50-58, Handbook for Designers of Instructional Systems, witnessed a realization on the part of the AF that application of modern instructional technologies might yield substantial improvements in the effectiveness and efficiency of AF training programs. In both documents, considerable emphasis has been placed upon achieving close correspondence between training program content and job performance requirements.

The Occupational Survey (OS) is an information source useful for accomplishing job analysis and specifying job performance requirements within the context of AF technical training. However, it does not, nor was it intended to, generate the kinds of data about job performance subtasks or elements and supporting skills and knowledges that are required to design instruction. These data are the products of a rigorous task analysis. The process by which a skilled instructional designer identifies the major procedural steps and makes inferences about skill and knowledge requirements is not well articulated. Additionally, those in the Air Training Command (ATC) who are responsible for conducting and documenting task analyses are Subject-Matter Specialists (SMSs), not educational technologists. The implementation of a simplified task analysis procedure/documentation system and a computer-based task analysis data bank may offer significant economies in the design and revision of technical training courses. A standardized task

analysis procedure would help insure that course content decisions are made on the basis of job performance requirements as moderated by training situation constraints; and a computer-based data bank would provide a means of storing, retrieving, updating, and disseminating detailed task analysis information. Ultimately, these economies might be expected to manifest themselves in the form of more effective and less costly training.

The primary objective of this study is to develop and field test a simple-to-use, reliable, valid, and cost-effective/time-efficient task analysis procedure for application by ATC training development personnel responsible for the design and conduct of technical training courses. A secondary objective is to make recommendations regarding the feasibility and utility of implementing a computer-based task analysis data bank and to submit a preliminary data bank design for consideration. End items include:

a. A handbook detailing a standard task analysis procedure that will provide an acceptable degree of uniformity and quality control over task analysis efforts at ATC Technical Training Centers (TTCs); and

b. A systems analysis of present and future AF task analysis requirements, with special emphasis on the recommendations regarding future plans for a task analysis data bank.

The investigative approach employed in this study is straightforward and comprehensive. In Phase I, task analysis procedures currently in use at ATC TTCs were characterized and evaluated, and recommendations for improving the task analysis effort were proposed. In Phase II, a standard procedure was specified and a prototype handbook was developed. It will be field tested at ATC TTCs, and revised on the basis of field test results. In Phase III, the task analysis handbook and the description of data bank requirements will be prepared, reviewed in conference with intended users and management personnel, and revised as necessary prior to finalization. Inherent in this approach is the assumption that continuous involvement of ATC training development and management personnel in the design, testing, and revision process will insure that the final product is useful and will maximize the probability that it will be accepted and implemented.

Phase I

Survey Procedures

A semistructured research interview was employed to gain insight into the task analysis procedures currently being utilized in the AF technical training community. Specific areas of inquiry were the relative percentage of time spent revising existing courses versus developing new ones; procedures currently utilized to accomplish, document, and validate subtask and

skill/knowledge analyses; and familiarity with and judged adequacy of the task analysis guidance provided in AFM 50-2 and AFP 50-58.

The sample of interviewees included a full range of training development personnel, including military and civilian education specialists. Instructional System Development (ISD) technicians, and master instructors, who had been or were currently involved with task analysis efforts at the five ATC Training Centers. In addition, training development personnel from the 3306th Test and Evaluation Squadron at Edwards AFB; the School of Aerospace Medicine, Brooks AFB; and the School of Health Care Sciences, Sheppard AFB, were also interviewed.

Results

We found that task analysis procedures and documentation methods utilized at the TTCs were widely variant. Documentation produced in response to inquiries regarding how the results of task analyses were recorded ranged from Plans of Instruction (POIs) to fairly detailed ISD worksheets, most of which were locally designed. It was our feeling that quality control of the task analysis effort across branches within the same group would have been difficult, at best. An integrated quality control program across TTCs would be virtually impossible. Therefore, an attempt to develop and implement a standardized task analysis procedure/documentation system for application at all TTCs seemed a worthwhile pursuit.

We also noted with some interest that no individual or group of individuals at the TTCs was ultimately accountable for the task analysis effort. The issue of accountability is, of course, closely related to that of quality control. For ATC to realize the maximum benefits associated with implementing a standardized task analysis procedure/documentation system and to insure a rigorous quality control program, an articulated accountability system must be defined and implemented.

Frequently heard comments regarding currently available ISD and task analysis guidance documents (AFM 50-2 and AFP 50-58) included, "too complex," "require too much paperwork," and "most applicable to the design of new courses." With regard to the final comment, in response to a direct survey inquiry, we found that training development personnel currently spend the great majority of their time (in excess of 95%) completing task analyses in support of the redesign of existing technical training courses. There seems to be a legitimate need for a simplified task analysis procedure/documentation system that can be applied in the revision of existing courses as well as the development of new courses. Additionally, a preliminary assessment of the feasibility of implementing an automated storage/retrieval system for task analysis data seems warranted. This type of data bank would facilitate the revision of existing courses and would support implementation of a quality control/accountability system.

Recommendations/Actions

Based on survey findings and our observations, we recommended that a simplified task analysis procedure/documentation system, including improved procedures for in-process review of task analysis efforts, be developed and field tested at ATC TTCs. Additionally, we recommended investigating the feasibility of providing an automated storage/retrieval system for task analysis data. The Air Force Human Resources Laboratory (AFHRL) and ATC directed us to proceed with the development of a prototype task analysis handbook. Further, ATC agreed to support field testing of the prototype handbook at the TTCs.

Phase II

Handbook Development

The task analysis handbook addresses the design and revision of technical training courses and presumes the existence of a comprehensive task listing in the form of a Specialty Training Standard (STS) or Course Training Standard (CTS). The handbook task analysis procedure represents a best-mix of procedures contained in existing documents and literature, while incorporating the comments and suggestions made by training development personnel during the Phase I survey.

The handbook presents task analysis as a three stage process. Figure 1 presents, in flowchart format, an outline of the handbook task analysis procedure.

Stage A consists of converting STS/CTS task and knowledge items into Preliminary Criterion Objectives (PCO). In Stage B, each PCO is examined and broken down into its component subtasks. Finally, Stage C consists of determining the skills and knowledges which underlie or support each subtask. It was our strong feeling that identification of supporting skills and knowledges had to be addressed if the task analysis effort was to achieve its two primary objectives: (1) insuring that only "need to know" content was included in a course, and (2) providing an adequate information data base to support preparation of objectives and test items. Stage C is primarily inferential in nature and therefore less amenable to proceduralization than other parts of the process. However, some guidelines are offered in support of Stage C activities.

It should be noted that there are a number of differences between the handbook procedures and the detailed task analysis guidance presented in AFP 50-58. First, the task analysis guidance in AFP 50-58 is fragmented, whereas the prototype handbook presents task analysis as an integrated process. Second, AFP 50-58 calls for a considerable amount of task analysis activity prior to finalization of the training standard, while the handbook assumes a training standard as the point of departure. Third, the handbook specifies a single format (the flowchart) for intermediate documentation, and a single form for final

Figure 1
Outline of Handbook Task Analysis Procedure

documentation. Importantly, too, the final documentation form is considerably simpler than the one presented in AFP 50-58. Fourth, the handbook is built on the assumption that task analysis will be performed by a Subject-Matter Specialist (SMS) who is relatively inexperienced in ISD theory and practice. Handbook procedures, therefore, do not require the SMS to conduct an instructional analysis. The procedures in AFP 50-58, on the other hand, call for the analyst to classify each knowledge being analyzed (e.g., chaining, associating) to determine proficiency levels for supporting skills and knowledges, and to specify the amount of practice required to reach proficiency. It is our feeling that these decisions are better left to instructional design specialists. Fifth, and finally, the handbook specifically calls for a series of reviews by SMSs at key points in the task anlysis process. The interaction between analysts and reviewers should provide an excellent safeguard against overtraining. It was our feeling that SMS review and verification is given insufficient emphasis in AFP 50-58.

Table 1
Differences Between AFP 50-58
and Task Analysis Handbook Procedures

AFP 50-58	Task Analysis Handbook
Fragmented Procedures	Integrated Process
Analysis Prior to Finalization of Training Standard	Assumes Existence of Training Standard
Complex Documentation	Simple Documentation
Assumes Instructional Design Expertise	Assumes Technical Subject Matter Expertise
Requires Managerial Review	Requires More Interaction and Review by Other SMSs during Task Analysis

Field Test Procedures

A two-stage field test of the prototype task analysis handbook will be conducted. Stage 1 consists of preliminary tryouts, while Stage 2 will be devoted to feasibility testing (i.e., formal evaluation).

Stage 1 Procedures and Results. Preliminary tryouts were accomplished to obtain information useful for revising the prototype handbook. The goal was to develop an empirical data base that could be used to

identify required revisions and make the handbook as useful as possible. A potentially important by-product of preliminary tryouts was a set of task analysis examples directly relevant to AF technical training. The three sites selected for preliminary tryout of the handbook were Keesler AFB, Edwards AFB, and Chanute AFB.

Every attempt was made to insure that the courses chosen for preliminary tryouts of the task analysis procedure encompass the full range of technical training. Basic and advanced training for "soft" skill courses, operator training courses, and maintenance courses were represented. Two or more courses per site were utilized as test beds. For each course, a duty area was selected, and a task performance item and a task knowledge item from within that duty area were chosen for analysis. For each course at each site, two SMSs participated in the preliminary tryout. One of these SMSs served as an analyst, the other served as a reviewer.

Analysts then employed the handbook procedures to analyze one task performance item and one task knowledge item from the selected duty area and documented the analyses. Task analysts were encouraged to ask questions, identify problems, and present suggestions for improving the procedure. If the analyst failed to understand an explanation, another wording or elaboration was attempted. If the analyst failed to understand an example, verbal clarification was provided. Problems encountered, explanations and additional information provided, and suggestions for improvement, as well as typographical errors and other kinds of difficulties that the analysts encountered, were recorded. Reviewers had two tasks during preliminary tryouts. Their primary task, of course, consisted of reviewing task analysis worksheets and documentation. A secondary function involved critically reviewing the handbook in an attempt to identify faulty wording, unclear passages, inadequate explanations, poor examples, improper sequencing, poor layout, typographical errors, and other difficulties. Additionally, general suggestions for improving the handbook and procedures described therein were solicited.

Additionally, each Technical Training Group (TTG) at each TTC provided a senior review team, consisting of an educational specialist and a senior SMS, which examined the handbook, identified problems and made suggestions for improvement, and completed a free-response questionnaire containing items related to the adequacy and practicality of the task analysis procedure/documentation system described in the handbook, as well as items related to appropriateness of style and format.

To reiterate, the objective of the preliminary tryout phase of field testing was to gather information that could be utilized to "fine tune" the handbook prior to feasibility testing (i.e., formal evaluation). At each test site, those training development personnel who participated as task analysis teams and as senior review teams generated a sizable number of suggestions for improving the handbook. There was at each

test site substantial overlap between the suggestions put forth by the two groups of participants. In our view, this close agreement constituted consensual validation and provided sufficient justification for revising the handbook in accord with the suggestions made. Not surprisingly, both the number of new and the number of major suggestions generated decreased steadily from site to site. We concluded that the preliminary tryouts had indeed served their primary purpose--a considerable amount of "fine tuning" had been accomplished.

Stage 2 Procedures. The three sites to be used for feasibility testing (formal evaluation) will be Lackland AFB, Lowry AFB, and Sheppard AFB. Three courses per site will be identified as test beds. For each course, a duty area will be selected, and a task performance item and a task knowledge item from that duty area chosen for analysis.

For each course at each test site, four SMSs, one senior SMS, and one training specialist will participate in the feasibility testing. The pool of four SMSs will be divided into two two-person task analysis teams. On each team, one SMS will serve as the analyst, the other as reviewer. The senior SMS and the training specialist will serve as a task analysis evaluation team.

Analysts will utilize the task analysis handbook to analyze the selected task performance item and task knowledge item from the chosen duty area and document the analyses. Those participants designated as reviewers will participate in the analysis and documentation activities in the manner prescribed in the handbook. The amount of time required by each team to complete each major step in the analysis will be recorded. Upon completing the analysis, each analyst and reviewer will be asked to complete a Handbook Evaluation Survey. The survey consists of 43 Likert-type items that solicit opinions regarding the task analysis procedures prescribed in the handbook as well as handbook format and style. Additionally, three free-response items are also included to allow respondents to indicate which handbook features they like best and least and to raise important issues not directly addressed in the survey.

Evaluators will then be asked to review the completed task and knowledge analysis and assess each analysis from the standpoints of accuracy, completeness, and overall adequacy as a basis for the development of objectives, the preparation of tests, and the design of instruction. They will also be asked to judge the degree of correspondence between the analyses produced by the two analysis teams.

Additionally, each TTG at each TTC will provide a senior review team, consisting of an educational specialist and a senior SMS, which will examine the handbook, identify problems, and make suggestions for improvement, and complete the Handbook Evaluation Survey.

The simplicity of the handbook procedure will be assessed by examining analyst, reviewer, and senior review team opinions regarding the readability of the manual, the clarity of the explanations offered, the adequacy of examples included, and the appropriateness of the terminology. These data will be gathered with the Handbook Evaluation Survey.

The validity of the handbook procedures will be assessed by examining the opinions of the task analysis evaluation teams with regard to: the accuracy of each analysis; the completeness of each analysis; and the overall adequacy of each analysis as a basis for developing objectives, preparing tests, and designing instruction. An overall rating of the quality of each analysis will also be solicited.

The reliability of the handbook procedures will be assessed by examining the correspondence between analyses for each course (evaluation team judgments), and the consistency of high correspondence across courses. The consistency with which the new procuedres produce high quality results will provide an additional index of reliability.

Summary and Conclusions

An investigative study was undertaken at the behest of ATC to review task analysis methodologies currently in use, to recommend improvements in current procedures, to develop a simple-to-use, reliable, valid, and cost-effective/time-efficient task analysis procedure. In addition, should a successful procedure be developed, the study would examine the feasibility of providing an automated storage and retrieval system for task analysis data.

Results from Phase I of the study included strong recommendations for development of a simple standardized procedure and documentation system, and establishment of accountability for task analyses. Furthermore, it was recommended that the procedure be oriented toward both course revision and initial course development.

A new task analysis procedure was developed to satisfy the ATC requirements. The procedure differed significantly from current AF recommended task analysis procedures in that it is simpler, designed for SMSs, requires streamlined documentation, requires accountability, and is an integrated process. Preliminary tryouts of the prototype task analysis procedures resulted in a handbook that could be formally evaluated. Conclusions about the success of the handbook must wait until the final formal testing has been conducted and evaluated.

References

Air Force Manual 50-2. Instructional System Design. Washington: Department of the Air Force, December 1970.

Air Force Pamphlet 50-58. Handbook for Designers of Instructional Systems (5 Volumes). Washington: Department of the Air Force, July 1973.